Chapter XXXIII
Internet Map Services and Weather Data

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INTRODUCTION

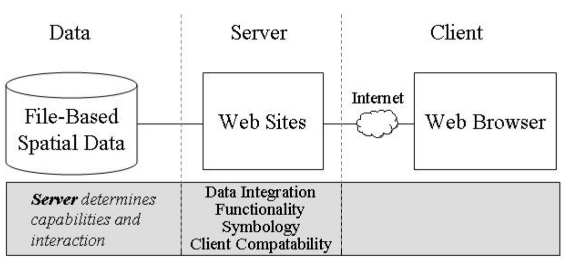
Internet map services (IMSs) are redefining the ways in which people interact with geospatial information system (GIS) data. The driving forces behind this trend are the pervasiveness of GIS software and the emerging popularity of mobile devices and navigation systems utilizing GPS (Global Positioning System), as well as the ever-increasing availability of geospatial data on the Internet. These forces are also influencing the increasing need for temporal or real-time data. One trend that has become particularly promising in addressing this need is the development of IMS. IMS is changing the face of data access and creating an environment in which users can view, download, and query geospatial and real-time data into their own desktop software programs via the Internet. In this section, the authors will provide a brief description of the evolution and system architecture of an IMS, identify some common challenges related to implementing an IMS, and provide an example of how IMSs have been developed using real-time weather data from the National Digital Forecast Database (NDFD). Finally, the authors will briefly touch on some emerging trends in IMS, as well as discuss the future direction of IMS and their role in providing access to real-time data.

BACKGROUND

The origins of IMS can be traced to the geospatial data sharing initiatives of the 1990s when spatial data sharing began in earnest. In the early 1990s, the World Wide Web (WWW) and browsers altered users' perception of the Internet. Suddenly users were able to see images and interact with the Internet through graphics and scripts and even access digital data. In the United States the creation of the National Spatial Data Infrastructure (NSDI) initiated an effort to develop standards for sharing data. By 1995 the vision for the NSDI to promote the sharing of data within the federal government and enhance sharing with state and local governments was solidified (Federal Geographic Data Committee, 1995).

Spatial data, which is defined as any data containing a locational component, have become widely available to the public through efforts of spatial data clearinghouses, governmental Web sites, and even nonprofit organizations, many of which were early NSDI initiatives. Through these spatial data clearinghouses, static spatial data were accessed traditionally via file transfer protocol (FTP). In cases such as these, the onus was on the user or client to identify, download, and manipulate data to comply with the desktop GIS environment. Temporal and real-time data have a more complex history. This type of information, which includes such diverse data types as traffic, hydrologic, and weather data, is difficult to maintain and provide access to due to its dynamic nature. For example, weather data, which encompasses everything from radar to precipitation to wind speed, are changing continuously and present the user with numerous data formats and types with which to contend (Van der Wel, Peridigao, Pawel, Barszczynska, & Kubacka, 2004). The past few years have seen advances on this front. For example, the National Weather Service (NWS) of the U.S. National Oceanic and Atmospheric Administration (NOAA) has developed several online applications that allow viewing of real-time weather information in a Web-based GIS environment. In addition,

Figure 1. Diagram of early IMS architecture



some data sets are being provided in a format that can be integrated into desktop GIS programs and tools have been created to convert the format and automate update processes within these programs (Liknes, Hugg, Sun, Cullen, & Reese, 2000). However, these tools do not allow for seamless integration of remote real-time databases into the desktop environment, an issue that the emergence of IMS has addressed.

IMS initiatives began in the mid 1990s. As the amount and availability of spatial and temporal data increased, so did the desire for increased interactive capabilities. Initially faced with the same historical constraints as in the past—large file size, long download times, and outdated data—data sites, programmers, and software companies began working toward providing users with the capability to bring data to their desktops without downloading the data: GIS over the Web became the new trend (Gold, 2006). The early steps toward visualization and subsequent desktop utilization of data via the Internet were basic. These applications were comprised of a set of data, predefined by the developer, which users could view via an interactive map interface that was built within a standard HTML (hypertext markup language) page. Analysis and navigation functionality, symbology, and compatibility with client browser software were controlled by the developer and server architecture (Figure 1). In many cases, the initial applications were environmental in nature, focusing on watershed health or water quality in a specific geographic area (Abel, Taylor, Ackland, & Hungerford, 1998). However, there were few if any customization capabilities and limited download capabilities in the first few years of the IMS movement. The user was simply viewing the data and turning data layers on and off. Another component of early IMS development was the use of a map as part of a search engine to access data (Kraak, 2004). As groundbreaking as these Web GIS applications were, they still had limited utility for those who wanted to acquire data and utilize them on their own desktops or who desired more than predefined static data sets.